ENGINEERING MECHANICS, PH.D.

The master of science and doctor of philosophy degrees in engineering mechanics are offered within a graduate program covering contemporary areas in both theoretical and applied mechanics. With the guidance of a major professor, a program can be designed to meet an individual student’s needs and interests.

The program is broadly structured into several main areas of instruction and research interests in mechanics of materials and astronautics: continuum mechanics, computational mechanics, dynamics and vibration, fluid mechanics, nanomechanics, solid mechanics, and biomechanics. Related fields in which minor work may be done include civil and environmental engineering, chemical and biological engineering, electrical and computer engineering, materials science, mechanical engineering, nuclear engineering and engineering physics, physics, geological engineering and geology, mathematics, statistics, and computer science.

Current faculty research interests include adhesive-bonded joints; composites; failure criteria; analytical and computational solid mechanics; analytical and computational dynamics; multibody dynamics; analytical and computational active and passive space-structure control systems; dynamic stability; nonlinear fracture mechanics of traditional and advanced materials; continuum mechanics; modal analysis; nanomechanics and nanotribology; fluid-structure interaction; non-Newtonian fluid flow; structural mechanics; viscoelasticity; viscoplasticity; cell mechanics; and biomechanics.

Laboratories are well equipped for experimental testing and research; these include holography, Moire, atomic force microscopy, vibration testing, and other optical methods for experimental mechanics research. The department has access to collegewide facilities. The Wisconsin Laboratory for Structures and Materials Testing has facilities for testing large structures, fatigue and vibration labs, and complements the department’s laboratories. The Materials Science Center provides state-of-the-art instrumentation, support facilities, and expert technical assistance for research and education in materials. Its facilities include scanning and transmission electron microscopes, image processing and analysis systems, surface and thin film characterization facilities, and x-ray diffraction facilities.

ADMISSIONS

The Graduate School sets minimum requirements for admissions (https://grad.wisc.edu/admissions/requirements). Academic program admission requirements are often more rigorous than those set by the Graduate School. Please check the program website (https://www.engr.wisc.edu/department/engineering-physics/academics/ms-engineering-mechanics) for details and admissions deadlines.

GRADUATE SCHOOL ADMISSIONS

Graduate admissions is a two-step process between academic degree programs and the Graduate School. Applicants must meet requirements of both the program(s) and the Graduate School. Once you have researched the graduate program(s) you are interested in, apply online (https://grad.wisc.edu/admissions).

FUNDING

GRADUATE SCHOOL RESOURCES

Resources to help you afford graduate study might include assistantships, fellowships, traineeships, and financial aid. Further funding information (https://grad.wisc.edu/funding) is available from the Graduate School. Be sure to check with your program for individual policies and processes related to funding.

PROGRAM RESOURCES

Admission and funding are separate decisions. Not all admitted students are offered support. International applicants must secure a research assistantship, teaching assistantship, fellowship, or independent funding before admission is final. A portion of the top domestic applicants are invited to visit Madison in March. The funding for RAs comes from faculty research grants. Each professor decides on his or her own RA offers. Funded students are expected to maintain full-time enrollment. See the program website (https://www.engr.wisc.edu/department/engineering-physics/academics/ms-engineering-mechanics) for additional information.

REQUIREMENTS

MINIMUM GRADUATE SCHOOL REQUIREMENTS

Review the Graduate School minimum academic progress and degree requirements (http://guide.wisc.edu/graduate/ #policiesandrequirementstext), in addition to the program requirements listed below.

MAJOR REQUIREMENTS

MODE OF INSTRUCTION

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<tr>
<th>Mode of Instruction</th>
<th>Face to Face</th>
<th>Evening/Weekend</th>
<th>Online</th>
<th>Hybrid</th>
<th>Accelerated</th>
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</thead>
<tbody>
<tr>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
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</table>

Mode of Instruction Definitions

- **Evening/Weekend**: These programs are offered in an evening and/or weekend format to accommodate working schedules. Enjoy the advantages of on-campus courses and personal connections, while keeping your day job. For more information about the meeting schedule of a specific program, contact the program.

- **Online**: These programs are offered primarily online. Many available online programs can be completed almost entirely online with all online programs offering at least 50 percent or more of the program work online. Some online programs have an on-campus component that is often designed to accommodate working schedules. Take advantage of the convenience of online learning while participating in a rich, interactive learning environment. For more information about the online nature of a specific program, contact the program.

- **Hybrid**: These programs have innovative curricula that combine on-campus and online formats. Most hybrid programs are completed on-campus with a partial or completely online semester. For more information about the hybrid schedule of a specific program, contact the program.

- **Accelerated**: These on-campus programs are offered in an accelerated format that allows you to complete your program in a condensed time-frame. Enjoy the
advantages of on-campus courses with minimal disruption to your career. For more information about the accelerated nature of a specific program, contact the program.

**CURRICULAR REQUIREMENTS**

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<tr>
<th>Requirement</th>
<th>Minimum Credit</th>
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<tbody>
<tr>
<td>Minimum Residence Credit Requirement</td>
<td>32 credits</td>
</tr>
<tr>
<td>Minimum Graduate Coursework Requirement</td>
<td>26 credits</td>
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</tbody>
</table>

- 26 credits must be in graduate-level coursework from E M A, math, physics, chemistry, computer science, or any other engineering department except EPD; courses with the Graduate Level Coursework attribute are identified and searchable in the university’s Course Guide.
- Overall Graduate GPA Requirement: 3.00 GPA required.
- Other Grade Requirements: Courses in which grades of BC, C, or below are received cannot be counted toward the degree except as follows:
  1) Credits of C will be allowed provided they are balanced by twice as many credits of A or by four times as many credits of AB.
  2) Credits of BC will be allowed provided they are balanced by twice as many credits of AB or by an equal number of credits of A.
- Assessments and Examinations: All students must take the Ph.D. qualifying examination. After acceptance of the student’s doctoral plan of study, the student must take an oral preliminary examination. Final oral examination is required at the end of the thesis work.
- Language Requirements: No language requirements.
- Doctoral Minor/Breadth Requirements: Technical minor: 10 credits in either a single department or multiple departments as approved by the advisor.

**REQUIRED COURSES**

The Engineering Mechanics Ph.D. program requires 72 credits beyond the B.S. degree, where 18–24 of the credits are typically research thesis credits. Students must complete the Engineering Mechanics M.S. (http://guide.wisc.edu/graduate/engineering-physics/engineering-mechanics-ms/#requirementstext) requirements and then complete at least two Engineering Mechanics and Astronautics (http://guide.wisc.edu/courses/e_m_a) (E M A) courses numbered 600 or above and an additional four courses numbered 700 level or above. The 700-level courses must include at least one E M A course, while the remainder may be from E M A or the list found in the student handbook, which is available from the program website (https://www.engr.wisc.edu/department/engineering-physics/academics/ms-engineering-mechanics). For students entering the program with an M.S. degree, three of the four 700-level courses must be E M A courses.

### GRADUATE SCHOOL POLICIES

The Graduate School’s Academic Policies and Procedures (https://grad.wisc.edu/acadpolicy) provide essential information regarding general university policies. Program authority to set degree policies beyond the minimum required by the Graduate School lies with the degree program faculty. Policies set by the academic degree program can be found below.

### MAJOR-SPECIFIC POLICIES

#### GRADUATE PROGRAM HANDBOOK

The Graduate Program Handbook (https://www.engr.wisc.edu/app/uploads/2016/09/EM-GradGuide_Fall2016_09.22.16_fnl_w_chklst.pdf) is the repository for all of the program’s policies and requirements.

### PRIOR COURSEWORK

#### Graduate Work from Other Institutions

With program approval, students are allowed to count no more than 6 credits of graduate coursework from other institutions toward the minimum graduate degree credit requirement and the minimum graduate coursework (50%) requirement. Coursework earned ten years or more prior to admission to a doctoral degree is not allowed to satisfy requirements.

#### UW–Madison Undergraduate

With faculty approval, students who have received their undergraduate degree from UW–Madison may apply up to 7 credits numbered 400 or above toward the minimum graduate degree credit requirement. This work would not be allowed to count toward the 50% graduate coursework minimum unless taken at the 700 level or above. No credits can be counted toward the minimum graduate residence credit requirement. Coursework earned ten years or more prior to admission to a doctoral degree is not allowed to satisfy requirements.

With faculty approval, students who have received an ABET-accredited undergraduate degree (not including UW–Madison) may be eligible to apply up to 7 credits of their undergraduate coursework toward the Minimum Graduate Degree Credit Requirement. No credits can be counted toward the Minimum Graduate Residence Credit Requirement, nor the Minimum Graduate Coursework (50%) Requirement. Coursework earned five or more years prior to admission to a master’s degree is not allowed to satisfy requirements.

#### UW–Madison University Special

With program approval, students are allowed to count up to 15 credits of coursework numbered 400 or above taken as a UW–Madison Special student toward the minimum graduate residence credit requirement, and the minimum graduate degree credit requirement. UW–Madison coursework taken as a University Special student would not be allowed to count toward the 50% graduate coursework minimum unless taken at the 700 level or above. Coursework earned ten years or more prior to admission to a doctoral degree is not allowed to satisfy requirements.
**PROBATION**

A semester GPA below 3.0 will result in the student being placed on academic probation. If a semester GPA of 3.0 is not attained during the subsequent semester of full time enrollment (or 12 credits of enrollment if enrolled part-time) the student may be dismissed from the program or allowed to continue for one additional semester based on advisor appeal to the Graduate School.

**ADVISOR / COMMITTEE**

Each student is required to meet with their advisor prior to registration every semester.

**CREDITS PER TERM ALLOWED**

15 credits

**TIME CONSTRAINTS**

The Ph.D. qualifying examination should be first taken no later than completion of the M.S. requirements, or the beginning of the fifth semester of graduate study, whichever comes first. Students entering the program with a master's degree in EMA, EP or NE from another institution, and taking the qualifying exam in that same major, must take the exam by the beginning of their third semester.

Students must submit the doctoral plan of study one month before the end of the semester following the one in which the qualifying exam is passed.

Candidates are expected to pass the Ph.D. preliminary examination no later than the end of the third year of graduate study, or by the end of the second regular semester following the one in which the Ph.D. qualifying examination was passed, whichever is later. A candidate who fails to take the preliminary examination within four years of passing the qualifying examination must retake the qualifying examination.

An oral examination on the findings of the Ph.D. research is required at the end of the thesis work. The candidate must apply for a warrant from the Graduate School through the student services office at least three weeks prior to the exam. The final oral examination must be taken within five years of passing the preliminary examination.

**OTHER**

Admission and funding are separate decisions. Not all admitted students are offered support. The funding for RAs comes from faculty research grants. Each professor decides on their own RA offers. Funded students are expected to maintain full-time enrollment.

**LEARNING OUTCOMES**

1. Demonstrate an ability to synthesize knowledge from a subset of the biological, physical, and social sciences to help frame problems critical to the future of their discipline.

2. Conduct original research.

3. Demonstrate an ability to create new knowledge and communicate it to their peers.

4. Fosters ethical and professional conduct.

**PEOPLE**

**Faculty:** Professors T. Allen, Blanchard, Bonazza, Crone, Fonck, Hegna, Henderson (chair), Lakes, Smith, Sovinec, Waleffe, Wilson; Associate Professors M. Allen, Schmitz, Witt; Assistant Professors Couet, Notbohm, Scarlat, Thevamaran; Affiliate Professors Bednarz, Bier, Graham, Ludois, Ma, Miller, Morgan, Nellis, Pfotenhauer, Porter, Prabhakar, Robertson, Szlufarska, Thomadsen, Trujillo, Vanderby, Emeritus Professors Abdel-Khalik, Bisognano, Callen, Carbon, Conrad, Cook, Corradini, De Luca, Drugan, Emmert, Hershkowitz, Kammer, Kulcinski, Mackie, Malkus, Moses, Plesha, Sandor, Schlack, Vogelsang

**GRADUATE SCHOOL RESOURCES**

Take advantage of the Graduate School's professional development resources (https://grad.wisc.edu/pd) to build skills, thrive academically, and launch your career.